

LOGICS FOR DATA AND KNOWLEDGE REPRESENTATION

Written Exam Session III - Monday 07-09-2009

SURNAME: **NAME:** **N.**

1. What are the most typical reasoning tasks, or services, provided by logic? Explain and discuss.
2. What are the main steps to model a piece of world in terms of logical modelling? Explain and discuss.
3. Let the following propositions be given.

$$\alpha = (A \vee B) \wedge (\neg C \vee \neg D \vee E),$$

$$\beta_1 = (A \vee B \vee C) \wedge (B \wedge C \wedge D \rightarrow E), \quad \beta_2 = (A \vee B) \wedge (\neg D \vee E)$$

1. For what i is $\alpha \models \beta_i$? (many answers or none possible, indicate)

2. Draw the Venn diagram of $\alpha \rightarrow \beta_i$ for those i such that $\alpha \models \beta_i$.

4. For all formulas $p = p(x, y)$:

- | | | |
|---|------------------------------|-----------------------------|
| 1. Is $\exists x \exists y p(x, y) \models \exists y \exists x p(x, y)$? | yes <input type="checkbox"/> | no <input type="checkbox"/> |
| 2. Is $\exists x \forall y p(x, y) \models \forall y \exists x p(x, y)$? | yes <input type="checkbox"/> | no <input type="checkbox"/> |
- If no provide a counterexample.

5. Represent the following propositions in an appropriate DL (define a DL KB if needed).

1. Every person has exactly a mother.
2. Every person has exactly a mother who is also a person.

6. Translate in English the content of the following DL knowledge base.

Chardonnay \sqsubseteq Wine \sqcap \exists servedWith.VealParmesan
 Roja \sqsubseteq Wine \sqcap \exists hasIngredient.Tempranillo
 RedWine \sqsupseteq Wine \sqcap \exists servedWith.MeatDish
 Tempranillo \sqsubseteq DeliciousProduct

7. Prove the following equivalences.

1. $\neg(C \sqcap D) \equiv \neg C \sqcup \neg D$. 2. $\neg \forall R.C \equiv \exists R. \neg C$

8. Let ontology \mathcal{O} defined by the set of the following axioms and assertions:

Person $\sqsubseteq \forall$ parent.Person, Person $\sqsubseteq \forall$ parent.Adult,
 Person(PAOLO), parent(PAOLO, JOHN).

1. Is $\mathcal{O} \models \text{Adult}(\text{JOHN})$?

2. What is the retrieval set $\{a \mid \mathcal{O} \models \text{Person}(a)\}$?

3. What is the realization set $\{C \mid \mathcal{O} \models C(\text{JOHN})\}$?

9. Let T be a complete theory. Is the extension of T by the Closed World Assumption (CWA) a complete theory?

10. Let default theory $\Delta = (D, W)$ be defined as follows.

$$D = \left\{ \frac{MA}{\neg B}, \frac{MB}{\neg C}, \frac{MC}{\neg F} \right\} \quad W = \emptyset.$$

Define Δ 's extensions, if any. Motivate in details your answer.